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Human-Wildlife Conflict in the Mountains of SAARC Region
Compilation of Successful Management Strategies and Practices

SAARC Forestry Centre
Thimphu, Bhutan

For copies, write to:
SAARC Forestry Centre
Post Box # 1284
Taba, Thimphu,
Bhutan

Tel: +975 2 365 260/ 365 148/ 365 181
Fax: +975 2 365 190
Email: karmatp@gmail.com

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Mountain Ecology Division
SAARC Forestry Centre
Thimphu, Bhutan
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Foreword

Human-Wildlife Conflict (HWC) occurs when the wildlife's requirements overlap with those of human populations, creating costs to residents and wild animals. It is more serious where wildlife population density is higher and habitats are fragmented. Such conflicts are becoming more prevalent as human populations increase and diversify, development expands, resources shrink, the global climate changes, and other factors increase the human-wildlife interface.

The problem is more serious in the SAARC region as the costs are more severe because of dense rural human population with considerably low income levels. Human Wildlife Conflicts is perceived as the major cause of poverty in rural Bhutan and the situation is not very different in other parts of the SAARC region. The economic losses due to small animals are also quite significant especially in the mountains.

If sustainable solutions for wildlife and people are not adequate, local population develops negative attitudes towards forests and wildlife, exacerbating the conflict and undermining conservation efforts. Hence, it is necessary to ensure that conservation solutions are socially, ecologically, economically and politically robust and sustainable. The SAARC Forestry Centre intended to identify and publish the successes from the SAARC region achieved in the field of Human-wildlife conflict resolution.

Six success stories presented here cover a wide range of innovative HWC resolution models dealing with early warning systems, sterilization efforts, effective and cheaper electric fencing, other barriers, offsetting economic losses through damage compensation and insurance, conservation education and economic incentives.

I would like to thank the authors for their valuable contribution and also appreciate the team at the SAARC Forestry Centre for having put in considerable efforts in screening the various papers received, selecting and editing the same to meet the format of this publication.

We hope that this publication titled 'Case studies on successful resolution of Human-Wildlife Conflicts in the mountains of the SAARC Region' would be useful to a range of stakeholders in the SAARC region as well as across the world for gaining insight, replication and further development.

Sangay
DIRECTOR

FOSTERING HUMAN–ELEPHANT COEXISTENCE IN THE VALPARAI LANDSCAPE, ANAMALAI TIGER RESERVE, TAMIL NADU

M. Ananda Kumar* and Ganesh Raghunathan

* Corresponding author: anand@ncf-india.org

Nature Conservation Foundation, 3076/5, IV cross, Gokulam Park, Mysore 570002, India.

Summary

Human-elephant conflict, leading to loss of lives of people and elephants and damage to property and crops, poses a major challenge for conserving elephants outside Protected Areas across Asia. The Anamalai hills (Tamil: Elephant Hills) is home to the second largest wild Asian elephant Elephas maximus population in India. The Valparai plateau, with 220 km^2 of tea and coffee plantations interspersed with patches of forests and Eucalyptus plantations, is a fragmented landscape home to several endangered and endemic species of Western Ghats including elephants. Extant rainforest fragments and riparian patches within tea and coffee plantations provide refuges for elephant use and movements across the plateau into surrounding protected areas. Our study since 2002 reveals that over the years about 100 elephants use plantations with consistent inter-annual movement patterns across the landscape. The Nadu Ar–Sholayar riverine system flowing through the middle of the plateau is critical for elephants, highlighting the need for developing native vegetation along the river with the involvement of local companies to facilitate free passage for elephants and minimize human-elephant interactions. There are also six major plantation companies, smaller estates, and 70,000 people who depend on plantations for their livelihood, indicating imperative for coexistence measures. Encounters with elephants that lead to human deaths and damages by elephants to buildings and food stores cause economic losses and trauma among local people and reduce their tolerance levels. Although elephants used the landscape year-round and there were seasonal peaks of conflict incidence (October - February), elephant presence and their duration of stay was not directly related to conflict. Based on spatial clusters and seasonal peaks of conflict, we have developed targeted mitigation efforts. On the Valparai plateau, human fatalities were due to unaware of elephant presence and their movements through plantations. During the study, we have implemented Elephant Information Network (EIN) that conveys advance information on elephant presence and their movements in plantations to local people to avoid any injury or fatal encounters with elephants. The information is conveyed through: (i) local television cable channel as a 'crawl', (ii) bulk SMS sent directly to local people, (iii) installation of mobile-operated elephant alert indicators (red LED lights) in strategic locations. These measures have been received positively by people and along with anti-depredation squad of the Tamil Nadu Forest Department have helped reduce incidence of conflicts during the past two and half years, with no human death due to elephants in 2013. The study reveals that simple, adaptable, and locally appropriate conflict mitigation techniques coupled with sustained efforts from stakeholders would foster human-elephant coexistence in modified landscapes.

Key words: Asian elephant *Elephas maximus*, early warning system, human–elephant conflict, plantations

Introduction

Conservation of wild Asian elephants and management of human-elephant conflict outside Protected Areas is one of the major challenges for state Forest Departments, conservation scientists, and stakeholders. In landscapes, where people and elephants share spaces, negative interactions may intensify into conflicts leading to loss of lives and damage to property and crops (Madhusudan 2003, Kumar *et al.* 2004, Fernando *et al.* 2005, Graham *et al.* 2010, Hedges and Gunaryadi 2010). Conflicts, if not addressed through appropriate prevention and mitigation measures, may also lead to decreased tolerance towards elephants among local people. Further, as few studies on African elephants (Burke *et al.* 2008, Ahlering *et al.* 2011) have revealed, human-induced pressures may increase stress levels in elephants and affect their survival in human-modified landscapes.

The Asian elephant (*Elephas maximus*) has been recognized as National Heritage animal by Government of India. Two-thirds of its population persists in non-protected areas either close to or within human-dominated landscapes and creates conditions for greater contact with people (Sukumar 1989, WWF 2000). Over the past few decades, human-elephant conflict has escalated with increasing human population coupled with hydro-electric projects, agriculture expansion, transportation networks and reservoirs within forested elephant habitats, resulting in fragmented elephant populations in Asia (Leimgruber *et al.* 2003). Elephant populations in small parcels of habitat with reduced resource availability may damage crops and human property in adjoining areas (Desai 1991, Madhusudan 2003). On average, nearly 400 people and about 100 elephants lose their lives annually besides crop and property damage due to conflicts between people and elephants in India (Rangarajan *et al.* 2010). Thus, human-elephant conflict resolution not only has scientific and conservation importance but a management and social need to retain traditional values of tolerance in people towards elephants in human-elephant relationships (Singh and Kumar 2014).

There have been various mitigation measures such as electric fences, elephant proof trenches, and early warning systems to resolve human-elephant conflict across Africa and Asia (Fernando *et al.* 2008, Graham *et al.* 2010). Nevertheless, very few of them have focused on impact of conflict mitigation measures in terms of cost-benefit ratio, functionality, feasibility of techniques, and benefits to people (Hedges and Gunryadi 2010, King *et al.* 2010, Graham *et al.* 2011, Chen *et al.* 2013). On the other hand, there is a lack of information on the efficacy of conflict mitigation techniques in terms of reduction in incidence of conflicts, sustainability, ease of adoption by local communities, and increased tolerance of people towards elephants.

The Anamalais (in Tamil: Elephant hills) in southern Western Ghats of India is an important conservation area for Asian elephants in India. These hills comprises of Tiger Reserves, Wildlife Sanctuaries, National parks, and Reserved Forests which span over 5700 km², holding the second largest wild Asian elephant population in India (Sukumar 1989, Baskaran *et al.* 2013). Over the last century, the Valparai plateau within the Anamalai hills has witnessed forest conversion that has left only remnant pockets of rainforest in a landscape dominated by commercial plantations. As this landscape is surrounded by protected areas, elephant use of these areas for foraging and wide-ranging seasonal movements (Kumar *et al.* 2010) will inevitably continue and bring the animals into contact and possible conflict with people.

In this article, we briefly explain the movement of elephants based on a four-year study carried out between 2002–2007 to understand critical areas used by elephants in the landscape, herd movements, spatial and temporal patterns of conflict incidence. Based on this research, we developed and implemented elephant early-warning systems as a pro-active conflict avoidance and mitigation measure. We describe the implementation of these systems and their effect on conflict incidence over a 3-year period between 2011 and 2014 in the Valparai plantation landscape.

Study area

The Valparai plateau, a 220 km² plantation landscape, is a critical landscape for Asian elephants in the Anamalai hills in southern Western Ghats. The plateau is a landscape matrix of tea and coffee plantations interspersed with rainforest fragments and *Eucalyptus* plantations. The Valparai plateau is in the midst of Tiger Reserves, Wildlife Sanctuaries, and Reserved Forests which form an important landscape for movement of elephants. At least 45 rainforest fragments within monoculture plantations act as refuge for elephants to move across the plateau (Mudappa and Raman 2007, Kumar *et al.* 2010, Mudappa *et al.* 2014, Figure 1). The plantations on the Valparai plateau belong to six major companies, a few smaller estates, and individual owners. As per 2011 census, the Valparai plateau has a human population of around 70,000 people and a majority of them have been working in tea and coffee plantations (Census of India, Ministry of Home Affairs 2011). As elephants use the landscape along with people whose livelihood depends on plantations, interactions and encounters may lead to human-elephant conflicts (Kumar *et al.* 2004). Resolving conflicts requires efforts to promote coexistence between people and elephants through pro-active, innovative measures with the active involvement of local stakeholders including the Tamil Nadu State Forest Department, plantation management, estate workers, conservation groups, and other citizens.

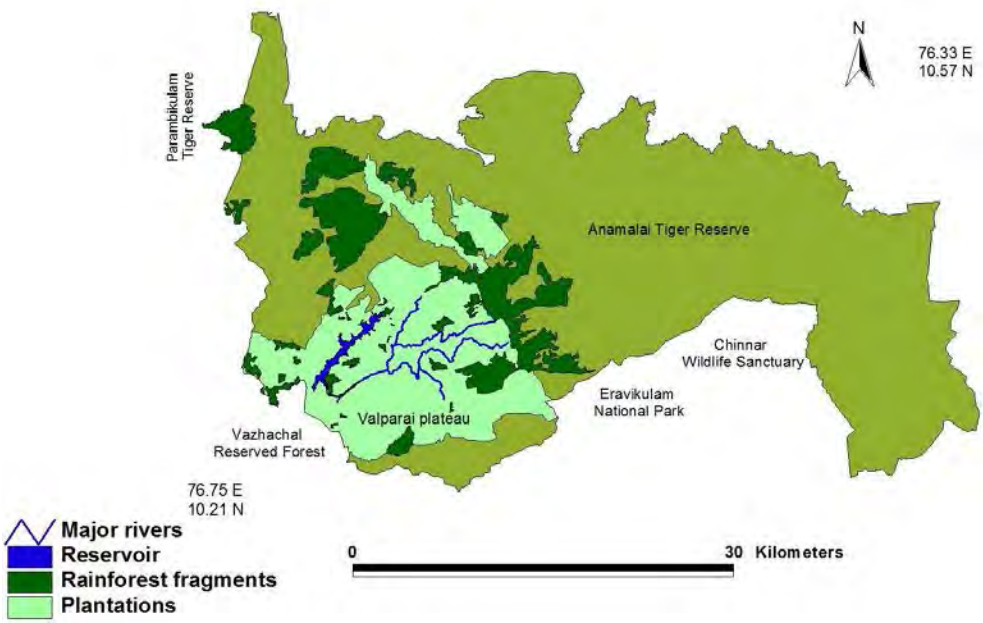

Figure 1. Map of Valparai plateau (light green) with rainforest fragments (dark green) and surrounding protected areas (green)

Tracking elephants and incidence of conflicts

Direct surveys, indirect signs such as feeding, dung, fresh tracks along movement paths, and information from local informants were used to detect elephants and record their movements on the Valparai plateau. Each individual elephant or herd detected were followed through plantations until they entered surrounding protected areas. Elephants in regular herds were identified based on age-sex composition, physical markings such as lumps, tears, ear shape, ear folding, degree of ear folding, tail length, tusk length and shape, herd size, age-sex composition, position of the young in relation to mother (Moss 2001, Kumar and Singh 2010). Habitat parameters such as habitat type, distance to nearest forest fragment, distance to nearest human settlement and plantation types were noted. Elephant locations (recorded on GPS units) were plotted on the study area map to understand critical areas of use and movement patterns across plantations (Kumar *et al.* 2010). Conflict incidents were recorded by visits to damage sites, where we noted information on date, place, time of incident, habitat type, GPS location, type and cost of material loss, records of injury or death of people, if any (Kumar *et al.* 2004).

Results and Discussion

Role of natural vegetation

We found that around 80 – 100 elephants use the Valparai plantations annually with three herds (around 45 - 50 elephants) that regularly spent about 8 – 10 months in a year on the Valparai plateau. Presence of natural vegetation in the form of rainforest fragments and riverine vegetation played a crucial role as habitat refuges, providing space for resting and foraging, and facilitated elephant movements across the plateau (Kumar *et al.* 2010). Tea, an open habitat, is primarily used by elephants to move between forest fragments. Our long-term research clearly indicates that the Nadu Ar – Sholayar riverine system, which flows in the middle of plateau forms a critical area for elephants to move across surrounding Protected Areas (Figure 2). Growing natural vegetation on either side of river with a width of 10 m would facilitate easy passage for elephant and minimize interactions with humans thereby reducing human-elephant conflicts on the Valparai plateau.

Human-elephant conflicts

Widespread human habitations and high human densities in the Valparai landscape witnessed regular movement of elephants and led to negative interactions in the form of episodic loss of human lives due to accidental encounters or damages to property. Property damage by elephants occurred mainly to ration shops and school noon-meal centres where food grains such as rice and lentils, salt and sugar were stored. As these food grain stores were either within estate worker's residential colonies or close to human habitations, damages also occurred to adjoining residences, causing fear and trauma among local people. Based on identification of these conflict-prone stores and buildings, specific recommendations were made to plantation companies and State Forest Department for conflict mitigation, and some of implemented measures were the following:

a. Ration shops that were attached to estate worker residences were moved to separate buildings that could then be better protected, which improved overall safety.
b. Storage of food grains in school noon-meal centres was discouraged which resulted in reduced incidences of damages to school kitchens by elephants.

c. Some companies insured buildings from damage, and as damage was offset by payments received for insurance claims, this reduced economic loss and requests for compensation from State Forest Departments
d. The State Government is pursuing a proposal for mobile ration stores and distribution to local people
e. Food grains was kept in more secure centralised stores and brought to distribution centres only on specific days, after which the store was cleaned and kept empty.
f. A few buildings, bungalows, and residential colonies were protected using small electric fences (instead of fencing off large areas of estate), which reduced costs of fencing and provided targeted protection

There is no damage to tea crop as it is non–palatable and negligible amount of damage to coffee bushes by elephants was noticed in plantations.

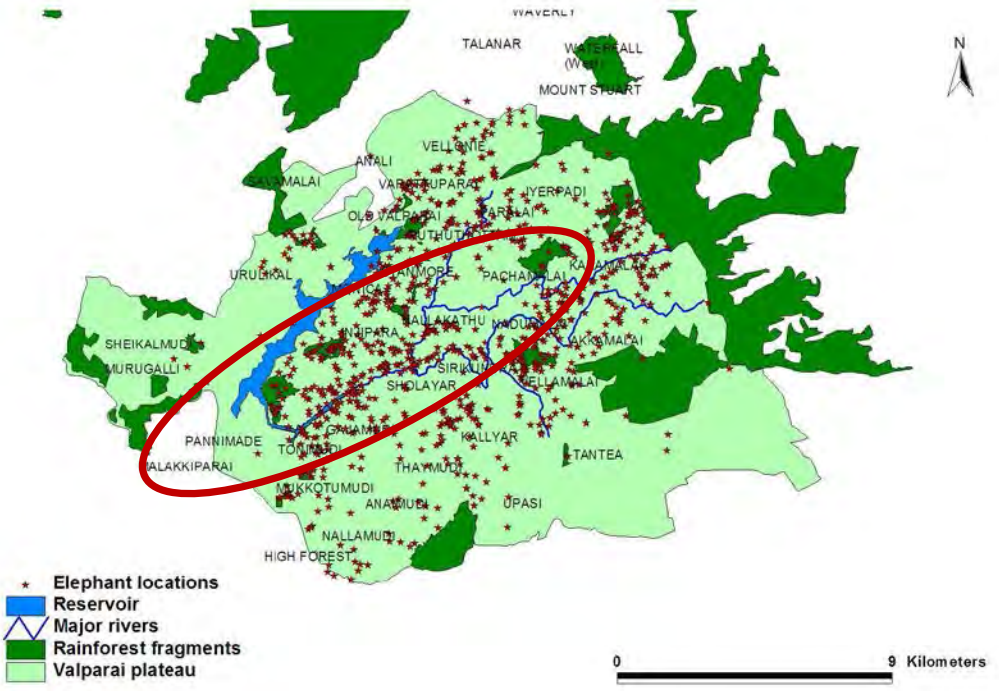

Figure 2. Distribution of elephant herd locations (red stars) on the Valparai plateau. High concentration of locations along Nadu Ar and Sholayar riverine system (red circle) in the middle of plateau forms critical habitat for elephant movements.

Human deaths due to elephants

Avoiding loss of life due to elephants is a critical aspect of human – elephant coexistence measures, as loss of life triggers anger, fear, and antagonism among local communities towards elephants. Execution of human-elephant coexistence measures with the involvement of local communities has far-reaching positive impacts in reducing pressures on elephants while fostering tolerance in local communities towards elephants.

There were 41 human deaths due to accidental encounters with elephants between January 1994 and September 2014. Most people (66%, 27 out of 41 incidents) lost their lives during a three-

month period between December and February which denotes peak conflict period within the year (Kumar and Raghunathan 2013). Investigating the circumstances of human deaths clearly reveals that most deaths (31 out of 41) occurred during unexpected encounters (people unaware of presence of elephants and encountering them when outdoors) and lack of safety at work and home. Nearly 72% of human death incidents (29 out of 41 incidents) occurred on main or estate roads. This suggested that conveying early intimation about elephants and their movement to people in plantations may help prevent unexpected encounters. In 36 out of 41 cases, lack of early warning was the primary cause for loss of life. The other fatal encounters were due to inebriation, misjudgement of elephant movement, and ignoring advance intimation. Thus, the conflict mitigation on the Valparai plateau would require:

- An '*early intimation*' to communicate about elephant presence and their movements to people as a measure to avoid direct encounters
- Provision of '*in-house'* warning systems in selected localities along elephant movement routes
- *Adequate coordinated efforts* by stakeholders in the management of human-elephant conflict on the Valparai plateau

Implementation of early warning measures

During the past several years, the Nature Conservation Foundation in cooperation and support from the Tamil Nadu State Forest Department and plantation companies have been implementing early warning systems to develop an effective *Elephant Information Network* (EIN) in the Valparai region in the following three ways:

1. **Use of Television network**: Location and tracking of elephants is carried out by a team comprising of indigenous people as a part of Conflict Response Unit (CRU), besides Forest Department field staff and local people. This information on elephant location is displayed as a 'crawl' on local cable TV channels after 5 PM on a daily basis to reach out to people as an early elephant intimation system. Currently, the cable channel covers nearly 5,000 families on the Valparai plateau.

2. **SMS service**: Bulk SMS service was initiated to send out text messages about elephant presence and their movements within plantations to people who are willing to receive information on their mobile phones. On a daily basis, these messages are sent in English and Tamil to people residing within a 2 km radius of the location of the elephant herd (Figure 3). The 2 km radius was chosen based on our long-term research because of the high likelihood (> 80%) that elephants would move within that distance over a 24-hour period.

Figure 3. Advance intimation about elephant presence over bulk SMS to people through short message service

Our recent analysis of people's response calls to the SMS initiative reveals that this measure has been extremely helpful and serves as a timely alert to the presence of elephants, allowing people to take adequate precautions to avoid direct encounters with elephants and safeguard property. It has also enabled multi-way communication between the conservation group, Rapid Response Teams of the Forest Department, and people by creating a “My Message” attitude among local communities.

3. **Installation of elephant alert indicators**: Mobile operated LED-light alert indicators were installed in 24 locations to signal the presence of elephants and their movements within a 1km radius of each light (Figure 4). These indicators are equipped with a SIM card and fitted with red flashing LED bulbs on a 10 m long pole and are located in strategic places that are visible from up to 1km away. Each light can be operated from any of three registered mobile phones. At least two persons from every “light locality” are registered with each light and are responsible for activating these lights when information regarding elephants is passed onto them. During the last two years, on an average, after the initial month of installation and training, the local community itself operated the lights 98% of the time. Additional areas were covered with voice-based elephant alert indicators by the Forest Department to widen the network of early warning to local people.

Other measures such as Rapid Response Teams from the Tamil Nadu Forest Department have been critical in reaching out to elephant locations and safeguarding people and property.

Figure 4. Mobile operated alert indicators for commuters in a residential colony in a tea estate indicating elephant presence in a kilometre radius from the light in the Valparai region. Photo: Kalyan Varma

Effectiveness of early warning systems

Reduction in incidence of property damage across years

Presence of elephant herds have been noticed throughout the year on the Valparai plateau. The number of days spent by multiple elephant herds or a single herd split into multiple sub-herds/solitary individuals (elephant herd-days) gradually increased from between Year 1 (2011 – 12, 658 elephant herd–days), Year 2 (2012 – 13, 1756 elephant herd–days), and Year 3 (2013–14, 1926 herd–days). Number of days spent by different elephant herds appeared to be higher during relatively dry period of November – April in Year 1 (n = 404 herd-days, 61.4%), Year 2 (n = 1139 herd-days, 65%), and Year 3 (n = 1279 herd-days, 66%). However, no statistical difference was noticed in time spent by elephant herds between dry and wet seasons across years (χ^2= 5.44, df = 2, p >0.05). Overall, number of conflict incidents decreased by 41% in Year 2 (n = 88) and 35% in Year 3 (n = 97) as compared to the Year 1 (n = 150). Damages to property by elephants were low across many months in Year 2 and Year 3 as compared to Year 1 but peaking between November and January (Figure 5). However, duration of elephant herds' was not significantly related to occurrence of conflicts on the Valparai plateau (r = 0.21, df = 34 , p >0.05).

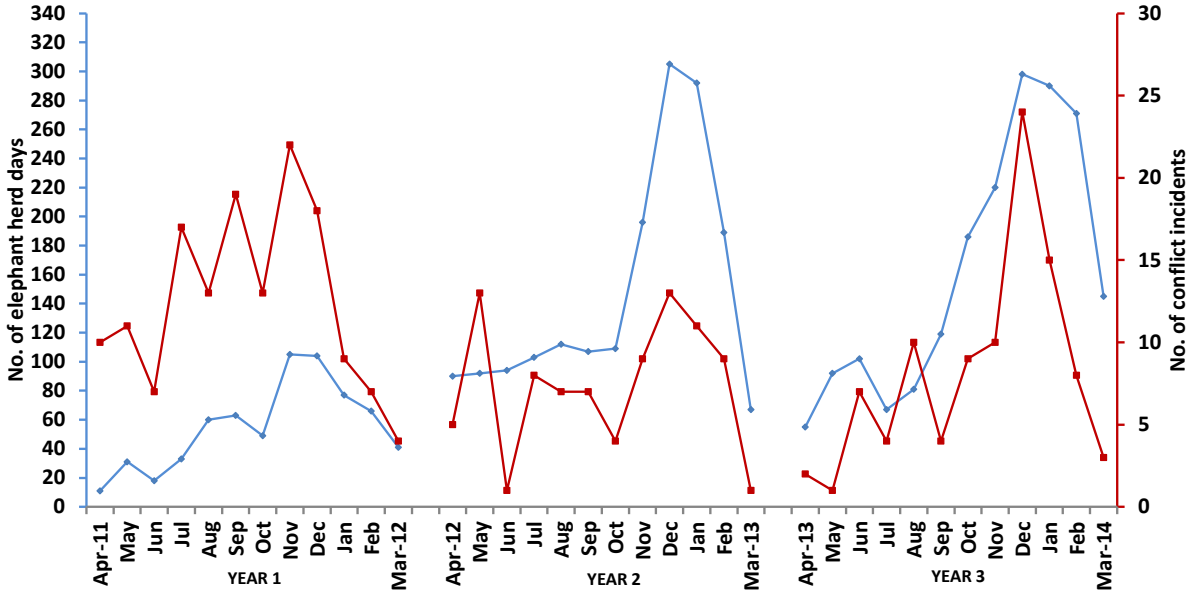

Figure 5. Monthly distribution of incidents of property damage by elephants and elephant herd-days over a three year period on the Valparai plateau

On the Valparai plateau, two ecological factors seem to determine elephant densities. One, during transition period from wet to dry, availability of fresh grass in swampy areas of tea and coffee plantations attracts elephants to spend more time in relatively open areas. Secondly, availability of water in rivers and streams passing through swampy regions of plantations and rainforest fragments on the plateau would influence elephant distribution. When elephants use these habitats for water or forage, human disturbance such as chasing of elephants may affect forage and water intake, behaviours such as feeding, resting, play etc., and may also lead to

break-up elephant herds into small sub-herds, thereby aggravating incidence of conflicts (Kumar and Singh 2010).

The decrease in number of incidents in the Year 2 and Year 3 from Year 1 is largely attributed to the efforts taken by the Forest Department field staff to safeguard property, timely intimation of communication about elephant presence, and cooperation of plantation companies and local people. However, steps should be taken to shift ration shops and noon-meal centres at least 100m away from habitations, change in food storage patterns coupled with adequate protective measures around food grain stores, and allowing elephants to move across plantations with no disturbance would further reduce incidences of property damage by elephants.

Reduction in human fatal encounter incidents

Intensive tracking of elephants and advance intimation through early warning systems to people for the past three years have been positively received by people. Collective efforts by the Forest Department and conservation organizations with the help of technological interventions resulted in gradual decrease in human fatalities from 2011 to 2013 with no incident of human death or injury due to elephants noticed in 2013 (Figure 6). However, there were two fatal incidents in February 2014. Circumstantial evidence indicates that one death occurred due to ignorance of early warning information and the second incident was due to fatal injury sustained while running away in panic and not due to direct attack by elephants. These incidents highlight the necessity to carry out sensitization programmes and communicate precautionary measures through interactive meetings with estate people.

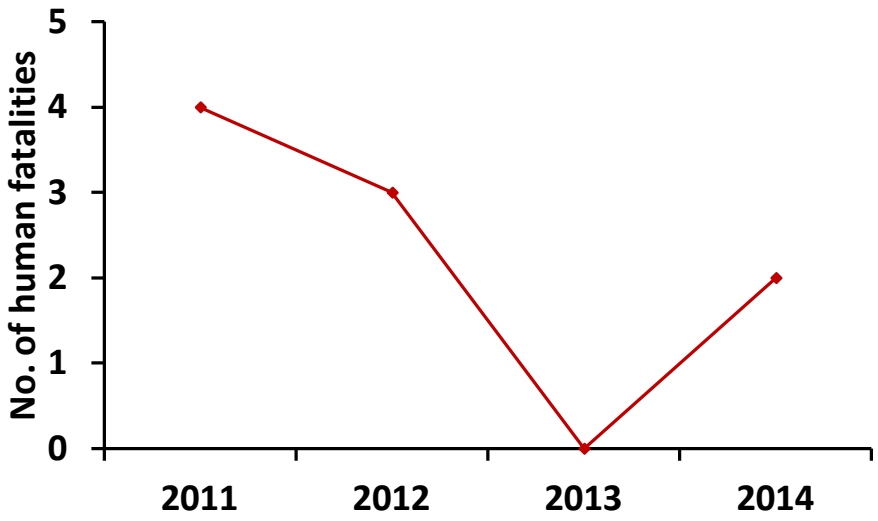

Figure 6. Distribution of human deaths due to elephants across years. Reduction in number of fatal encounters as result of early warning systems on the Valparai plateau

These human-elephant coexistence measures, particularly bulk SMS service, need to be strengthened by institutionalizing these measures for long-term sustainable implementation through the Forest Department. This will enable sustainable and effective avoidance of fatal incidents, reduce property damage by elephants and promote long-term coexistence. Unlike in many other places where incidences of human-elephant conflict are on rise, there has been a down-trend in occurrence of property damage and loss of human life due to elephants on the

Valparai plateau. Such collective efforts by stakeholders, Forest Department, and conservation and scientific organizations would further enhance human-elephant coexistence in the Valparai region. As a long–term measure, there is a need to protect existing rainforest fragments along elephant movement areas by declaring them as satellite elephant reserves and developing natural vegetation along Nadu Ar and Sholayar river with the involvement of plantation companies, which would minimize human-elephant interactions on the Valparai plateau. This study highlights the importance of long-term research and monitoring of elephants and developing science-based mitigation techniques that are locally adaptable and suitable that can be implemented with the involvement of stakeholders in order to achieve effective management of human-elephant conflict and promote coexistence (Kumar and Raghunathan 2013).

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ANANDA KUMAR

M. Ananda Kumar is a Scientist at the Nature Conservation Foundation. He has been involved in wildlife research and conservation of mammals for over 20 years. His PhD in Psychology involves studying Asian elephant use, movements, and their behaviour and conflicts with people in a human-dominated landscape in the Anamalai hills in southern India. This work led to on-ground implementation of innovative measures to minimize conflicts between people and elephants. These measures have been recognized and are being promoted by the Tamil Nadu State Forest Department. This work was honoured by the prestigious Carl Zeiss Wildlife Conservation Award in 2012. His work features in the academia in the form of 20 peer-reviewed scientific papers and several technical reports. Ananda Kumar is currently involved in understanding human-elephant interactions across forest-farm landscapes in India.

anand@ncf-india.org

GANESH RAGHUNATHAN

Ganesh Raghunathan is a Research Affiliate and wildlife photographer at the Nature Conservation Foundation. He is involved in developing Elephant Information Network in the Anamalai Elephant Programme which enhances safety of people and reduces pressure on elephants as a result of human-elephant negative interactions. His interests lie in understanding elephant behaviour in modified landscapes to augment effective human - elephant conflict management in the Anamalais. Over the past few years, he has witnessed and documented some of the rare and intimate moments of elephant life. His work featured in national and international wildlife magazines and print and online media. Ganesh is also actively involved in capacity building of frontline staff of the Tamil Nadu Forest Department to address human-elephant conflict situations in the Anamalai hills.

ganesh@ncf-india.org